

1434

Clinch River Water Sampling Data

MEMO TO FILE

SUBJECT: Clinch River Background Levels

Per J. D. McCluen, the figures given below represent initial evaluation of the uranium content of the Clinch River bottom between the inflow of White Oak Creek and Norris Lake; they should thus be of the same order of magnitude as the uranium background of the river bottom at the ORGDP. In all cases, analyses of water samples taken at the same points as the river bottom gave results less than 6.2 ppb of uranium, which corresponds to a value of 4.3×10^{-10} $\mu\text{C/cc}$. This may be compared to a value of 2×10^{-5} $\mu\text{C/cc}$, as a permissible limit for natural uranium in drinking water for continuous use by the general population.

For the river bottom samples, number 1 was taken some 100-200 yds. below the point of inflow of White Oak Lake, and number 2 was taken some 100-200 yds. upstream from this inflow point. Samples numbers 1 through 7 were taken at spots approximately equally distributed between point number 2 and Clinton. Sample number 8 was taken in Clinton, sample number 9 was taken approximately halfway between Norris Lake and Clinton, and sample number 10 was taken in Norris Lake. All of the samples are mud or silt except the one taken at Norris Lake, which had considerable rock. The two results given for samples 1, 2, and 10 represent different analyses of the same sample and do not represent different samples.

Sample Number	Concentration	
	ppb.	$\mu\text{C/ml}$
1	13; 25	4×10^{-9} ; 9×10^{-9}
2	50; 33	17×10^{-9} ; 11×10^{-9}
3	33	11×10^{-9}
4	25	9×10^{-9}
5	17	6×10^{-9}
6	42	14×10^{-9}
7	50	17×10^{-9}
8	33	11×10^{-9}
9	25	9×10^{-9}
10	83; 67	28×10^{-9} ; 23×10^{-9}

Note: In this usage, the μC is defined in accord with NBS Handbook 69 and is thus taken as about 7.4×10^4 dis./sec.

HFH:amh

9/22/60

174, 100
H. F. Henry
Safety, Fire, and Radiation Control

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Technical Information Office
Oak Ridge K-25 Site

*File (Env. Sci. Div.)
Water Div.*

MEMORANDUM
OF
CONFERENCE ~~OR CONVERSATION~~

DATE: August 15, 1960 TELEPHONE() PERSONAL(XX)

PARTIES: (Originating) H. F. Henry, W. J. McCluen, H. J. Culbert, N. B. Schultz

(Other) _____

SUBJECT: Radioactivity levels in Clinch River between OEGEP and Norris Lake

DISCUSSION: A proposed study of the current radioactivity levels in the Clinch River involving water and mud sampling to be performed by the Process Engineering Division; discussed such aspects as the sampling points, quantity of sample required, multiplicity of samples, frequency of schedule, and laboratory analyses to be made.

CONCLUSION OR

AGREEMENTS: Process Engineering Division (Process Laboratory Department) personnel are to collect samples of water, suspended silt (when available), and stream-bottom mud for analyses for uranium concentration, beta and alpha activity. Each sample is to be in duplicate, with a quantity sufficient of each sample retained for a third run as required for statistical significance. Tentative schedule: initial series of samples as soon as possible in August 1960; to be repeated in about six months during a winter month.

Locations proposed: (1) Below White Oak Creek, (2) Above White Oak Creek, (3) Gallagher Bend, (4) Below Scarboro Creek, (5) Above Scarboro Creek, (6) Edgemore Bridge, (7) Below Clinton, (8) Above Clinton, (9) Below Norris Dam, (10) Norris Lake.

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Date

cc: *A. F. Becker*

NBS:nbs

WCX-2402 (3-55)

MEMO

AVOID ORAL INSTRUCTIONS

Date 12/14 19 59

To Dr. H. F. Henry

Re: ORNL Waste Release to
Clinch River

As mentioned previously, the high value of 2116 dis/min/100 ml obtained on a supposedly finished water sample does not appear to be a valid measurement of the influent water activity. Bill thinks this came from backwashing the filters.

Results since this time show a steady decline as noted below:

12/4/59 - 536 Beta - dis/min/100 ml

12/5/59 - 312 " "

12/6/59 - 93 " "

12/7/59 - 273 " "

12/8/59 - 232 " "

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AFB:la
No RC

Signed

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A. F. Becher
Safety and Health Physics

258-2443

WCX-408 (Jan'48) 7-12 DATA SHEET

M E M O R A N D U M

To: Mr. A. F. Becher

Subject: Radioactivity of Clinch River at ORGDP

On Monday morning, November 2, 1959, the ORNL Area Monitoring Group notified ORGDP Safety and Health Physics that a radioactive leak of spent fuel elements had occurred over the weekend; subsequent newspaper releases suggested that the incident began late Friday afternoon. The gates of the dam reportedly had been closed Sunday morning to hold back what ORNL believed to be the major portion of the spill. Initial counting results of a sample of the water impounded behind White Oak Dam indicated a level of 225,000 dis./min./100 ml gross beta. The following morning the Knoxville "Journal," and that evening the "News Sentinel" as well as the "Oak Ridger" carried stories on the spill; clippings are filed in the Safety and Health Physics office. ORNL qualitative analyses indicated the radionuclides to be mainly Ruthenium and Curium, with lesser concentrations of Cerium, Neptunium, Americium, Plutonium, and Strontium; the latter being estimated at 10% of the total. Gross alpha activity of 14,000 dis./min./100 ml or about 8×10^{-5} $\mu\text{c/ml}$ was attributed to Americium 40%, Curium 30%, Plutonium 20%, and Neptunium 10%. For comparison, it may be noted that the Handbook No. 69 MPL_w for 40-hour week occupational exposure is 1×10^{-4} $\mu\text{c Pu}^{239}/\text{ml}$. Early "guesstimates" of the total quantity of radionuclides involved varied widely from 5-500 curies.

ORGDP records indicated that the average beta activity in the plant sanitary water during the previous three-month period was 24 dis./min./100 ml. Using the MPL_w of 4×10^{-6} $\mu\text{c Sr}^{90}/\text{ml}$ (NBS Handbook No. 69, 40-hour week occupational exposure) which is equivalent to 888 dis./min./100 ml, the 13-week MPL was computed to be 11,544 dis./min./100 ml, essentially all usable during the 13th week.

On Tuesday, November 3, 1959, about 10:30 a.m., ORNL "cracked open" the White Oak Dam, releasing impounded water to the Clinch River at about 5-10 ft.³/second. Special sampling by ORGDP Utilities was started on the 4-12 shift, November 3, 1959. These results are shown graphically in figure 1 and are listed in table 1 along with the results of determinations by the ORNL "hot" lab, which apparently has a lower limit of detection of about 1000 dis./min./100 ml. Results of subsequent analyses of five duplicate samples by the ORNL "cold" lab and the ORGDP uranium measurements lab compared more favorably, averaging 459 and 486 dis./min./100 ml, respectively.

On Thursday, November 5, 1959, ORNL indicated that as of 2:00 a.m., the White Oak Lake activity level was approximately 150,000 dis./min./100 ml gross beta, or about one-fourth to one-half the peak value. At 5:00 a.m., November 5, 1959, the peak reading of 901 dis./min./100 ml was recorded at the Clinch River influent to the ORGDP sanitary water plant.

On Friday, November 6, 1959, ORNL reported that as of 7:30 a.m. the White Oak Dam was fully open, there was no backlog of radionuclides, and normal flow of White Oak Creek was re-established. At this time, the gross beta activity in

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William J. Smith
Technical Information Officer
Oak Ridge K-25 Site

4/18/95
Date

White Oak Creek reportedly was about 50,000 dis./min./100 ml, or approximately double the levels noted during "normal" operations.

Levels up to 150 dis./min./100 ml prevailed in the Clinch River influent to the ORGDP sanitary water plant through Wednesday, November 11, 1959. By Thursday, November 12, 1959, beta activity levels at this location had fallen below the ORGDP P.A.L. of 89 dis./min./100 ml (1/10th of the NCRP Sr⁹⁰ MPL for 40-hour week occupational exposure, NBS Handbook No. 69).

It may be noted that during the period involved, the Clinch River flow remained essentially stable at about 5000 ft.³/second, paralleling the average annual flow noted during 1957 and 1958, and providing the associated dilution factor of the mixed fission product waste material released from ORNL.

On Friday, November 13, 1959, sampling of sanitary water from nine system loops and end-of-line locations, including K-1001, K-25 Process Area, the pump houses, and the Powerhouse Area, indicated an average gross beta activity of 34 dis./min./100 ml, apparently reflecting the fact that there is no residual activity within the distribution system.

During an 18-hour period beginning on the 4-12 shift, November 5, 1959, hourly samples of raw, settled, and filtered water were obtained at the K-1515 Sanitary Water Plant. Lab results indicated that during water purification up to the point of filter saturation, settling alone removed an average of 53% of the total beta activity, while settling plus filtering removed about 68% of the total beta activity associated with the radionuclides present in this release, with elements such as Sr⁹⁰ and Ru¹⁰⁶ presumably remaining in solution. The need for increased frequency of washing of filters, usually performed on loss of head or 72-hour intervals, was indicated by the beta activity of the finished water approaching the beta activity of the raw water.

NBS:1a

Attachments (Figure 1 and Table 1)

November 17, 1959

No RC

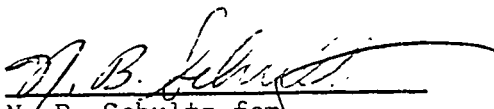

N. B. Schultz for
Safety and Health Physics

TABLE 1

GROSS BETA ACTIVITY IN CLINCH RIVER
ORGDP SANITARY WATER PLANT INFLUENT

DATE	11/3	11/4	11/5	11/6	11/9	11/10	11/11	11/12
C.R. FLOW (ft.3/sec.)	4934	5128	5250	5260	4220	4800	5010	5300
12 Midnight		(1000)		524				
1 A.M.		9	682(0)	377				
2 A.M.		(0)		394				
3 A.M.		(500)		650				
4 A.M.		(1500)		476			33	63
5 A.M.		65 (500)	901(0)	504				
6 A.M.		(500)		411				
7 A.M.		(1000)		349				
8 A.M.				167	112		133	68
9 A.M.			556			152		
10 A.M.				59				
11 A.M.				75				
12 Noon		637	221	94				
1 P.M.								
2 P.M.				166				
3 P.M.				49				
4 P.M.			230					
5 P.M.	1	529 (1000)	408					
6 P.M.			235					
7 P.M.			417					
8 P.M.			374			40	14	
9 P.M.	19	623 (1000)	550					
10 P.M.			433					
11 P.M.	(1000)*		509					

* ORNL "hot" lab results in parenthesis.

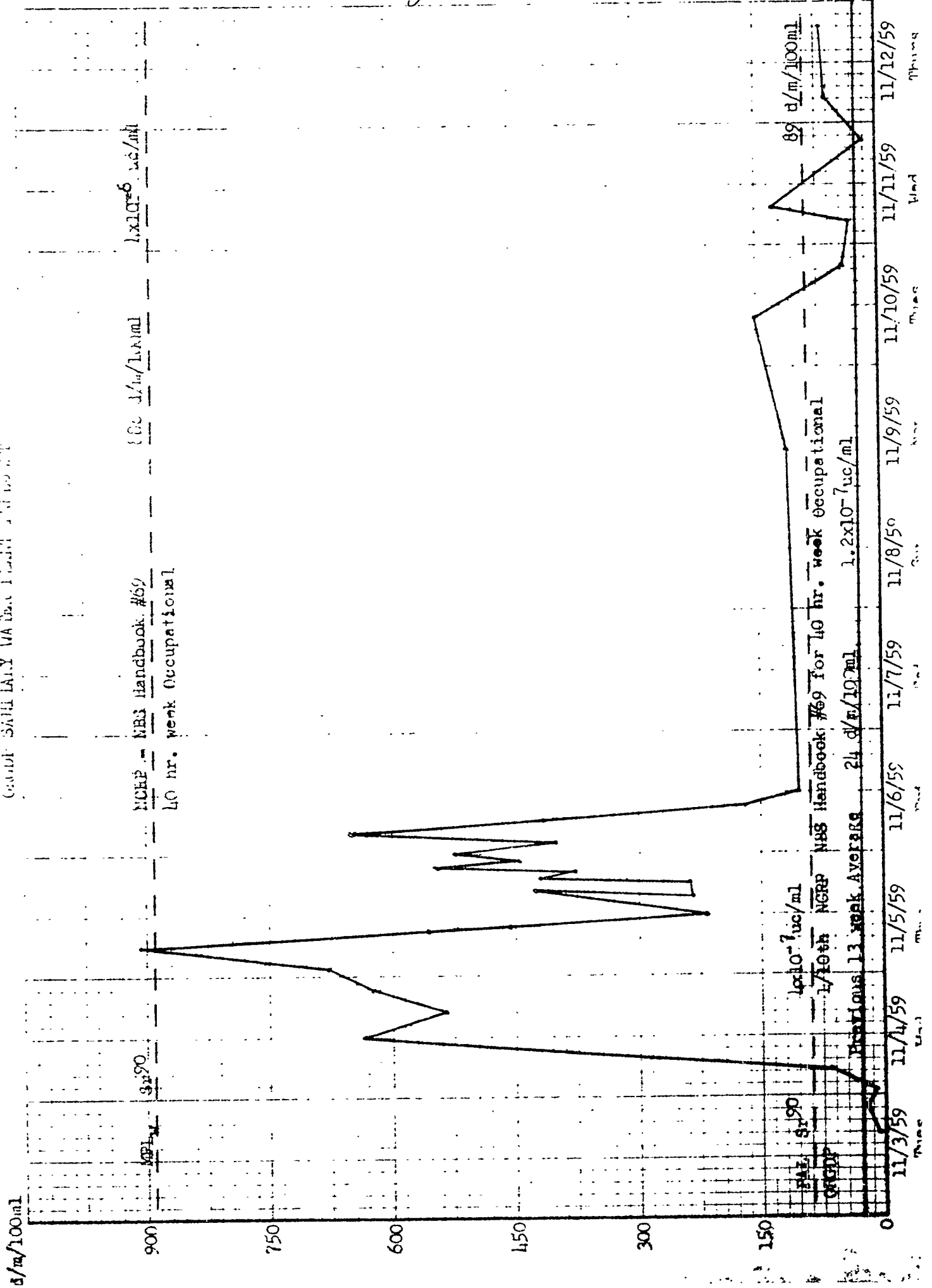
NBS:1a

11/17/59

Figure 1

CROSS BETA ACTIN IN CLINCH RIVER

GROUP: SOUTH LATE VA DEPT. 100000



Material on Water and Mud in Classified File

1. Tabulation of Samples of Clinch River
Water, letter dated 8-11-48 from
W J Clossey to T H J Barnett (ORNL)

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Arvin D. [Signature]
Technical Information Officer
Oak Ridge K-25 Site
Date 4/13/95

January, 1957 - Clinch River Flow (cfs) at Scarbrooke ^{Gauging Station}

1- 12,790	(6,700)	25- 4,857	(3,230)
2- 12,657	(6,790)	26- 3,667	(1,930)
3- 12,790	(6,850)	27- 5,523	(2,620)
4- 10,790	(6,890)	28- 5,857	0
5- 6,790	(3,470)	29- 11,177	0
6- 957	(0,130)	30- 7,257	(2,540)
7- 486	(2,810)	31- 13,390	(6,780)
8- 4,723	(6,280)	<hr/>	
9- 5,190	(5,170)	Total - 210,416	
10- 5,723	(5,630)	Monthly Average - 6,788 ft ³ /sec	
11- 5,257	(5,420)		
12- 5,323	(6,220)		
13- 5,790	(6,210)		
14- 5,790	(6,200)		
15- 5,790	(6,240)		
16- 5,790	(6,950)		
17- 7,123	(7,840)		
18- 7,123	(7,810)		
19- 6,990	(7,800)		
20- 6,990	(7,760)		
21- 6,923	(7,420)		
22- 6,390	(4,000)		
23- 4,923	(4,950)		
24- 6,190	(3,430)		

(156,100 Av 5,030)

Feb. 28. 8390	20. 20990	12. 26870
8390 8323	21200 21,130	27080 26,870
8190 (8,490)	21200 (20,870)	26660 (25,820)
27. 8190	19. 21200	11. 25190
8190 8323	20990 21,060	24860 24,980
8590 (8,540)	20790 (20,770)	25190 (23,500)
26. 10,990	18. 20790	10. 25820
12390 11,923	20990 20,997	26240 26,030
12390 (10,540)	21410 (21,030)	26030 (21,400)
25. 12390	17. 23930	9. 25820
12390 16,377	25400 24,910	26240 25,960
24350 (12,530)	25400 (23,240)	25820 (21,400)
24. 13990	16. 25400	8. 24770
20190 18,123	25400 25,470	25400 24,700
20190 (14,270)	25610 (25,500)	23930 (21,400)
23. 16590	15. 25820	7. 23930
20190 18,790	25820 25,820	23300 23,440
19090 (16,630)	25820 (25,590)	23090 (21,340)
22. 19190	14. 26030	6. 23090
20790 20,257	26030 26,100	22880 23,020
20790 (18,720)	26240 (25,690)	23090 (21,520)
21. 20790	13. 26450	5. 23090
20790 20,927	26450 26,520	23090 22,950
21200 (20,800)	26660 (25,760)	22670 (21,540)

2. f- 21830

19790 19,603

17190 (20,030)

3. 12790

12390 12,990

13790 (11,990)

2. 15,990

19,190 18,257

19,590 (8,770)

1- 17,190

18,790 17,990

17,990 (8,610)

Total 581,840

Arg. 20,780

Power
House
Gearing

Total 526,540
Arg. 18,800

	CWB	Yearly	Number
Jan 31	718	136.39	
Feb 28 (58)	759	(28) 42.24	
Mar 28	1039	(31) 240.39	
Apr 30	2098	82.03	
May 31	801	91.89	
June 30	618	117.91	
July 31	538	118.44	
Aug 31	446	135.96	
Sept 30	333	186.95	
Oct 31	448	180.91	
Nov 30	845	139.19	4.23
Dec 31	1443	69.43	
1935		1544.23	4.23
Factor	10086		
on C. family			

Aug. 28
8643
324

	This Y.	Last Y.	This year	Last year
Aug. Bre. tallies	30	14	28	39
Uncon. Conc in Poplar	31	45	41	124
" " Chick	3.6	1.5	2.8	3.4

2
27.91
9602
344

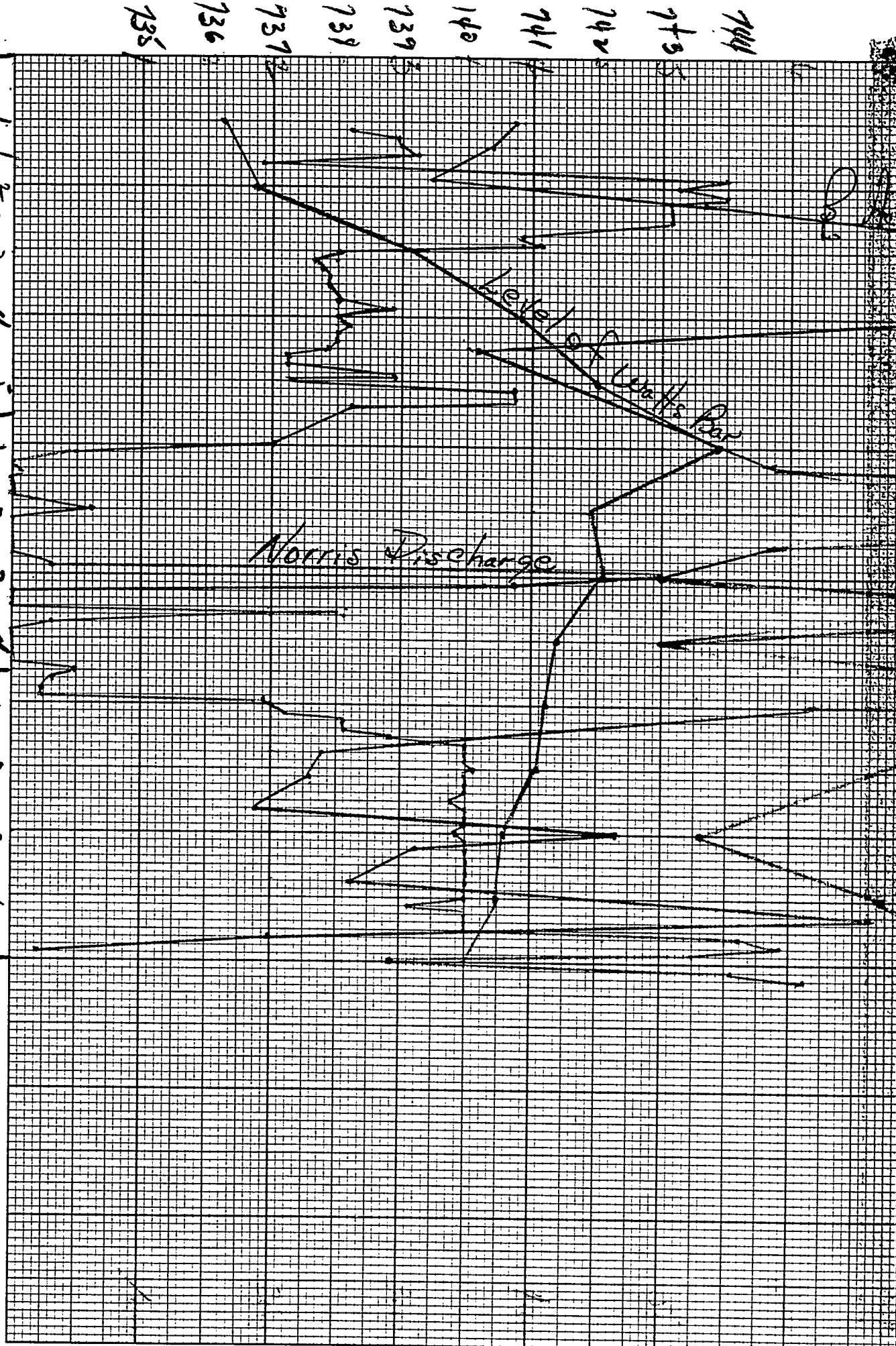
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April

May

June

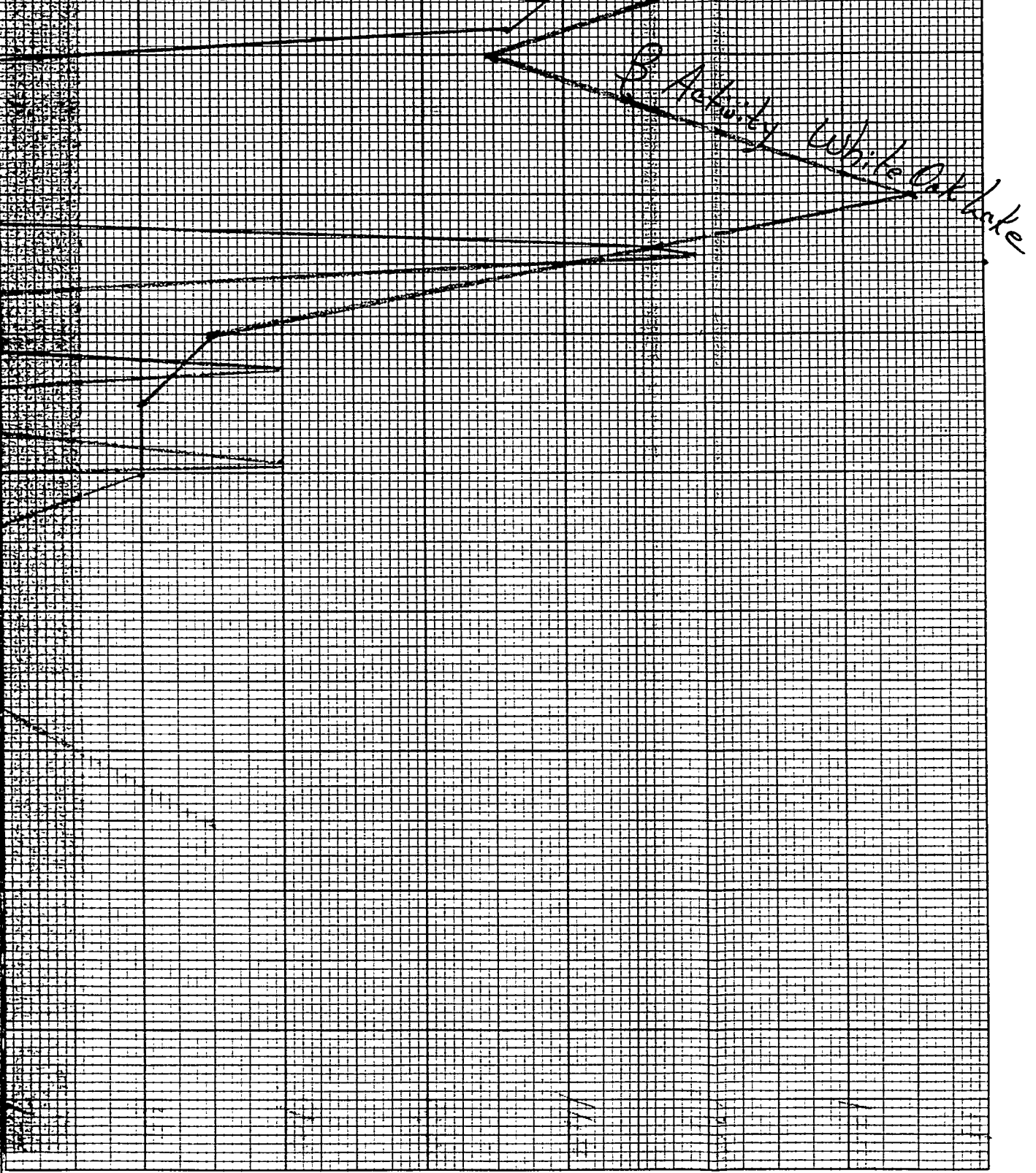
1 2 3 4 5 1 2 3 4 1 2 3 4



Sanitary Water Intake

Activity White Oak Lake

186-



INTER-COMPANY CORRESPONDENCE
UNION CARBIDE NUCLEAR COMPANY
A Division of Union Carbide and Carbon Corporation

To: Mr. J. E. Rothfleisch
Building K-1401

Plant: Oak Ridge Gaseous Diffusion

Date: March 26, 1957

Copies To: Mr. J. C. Barton
Mr. H. F. Henry ✓
Mr. K. M. Jones
Dr. S. Katz
Mr. T. Kwasnoski
Mr. D. M. Lang
Mr. T. C. Whitson
Technical Division K-1005 File (RC)

Subject: Fluorides in ORGDP Area
Waters, July 1956 -
January 1957

KLI-4017

Submitted herewith are the results of a six months' survey, performed at your request, of fluoride concentrations in the ORGDP area waters. Semi-weekly samples were taken by the Utilities Department in the following locations: Poplar Creek at junction with Clinch River, Clinch River at K-1513 pumphouse, and the Clinch River, one mile downstream of Poplar Creek junction. The results, expressed in parts per million of fluoride ion, are presented in table I.

T. C. Whitson
T. C. Whitson

T. Kwasnoski
T. Kwasnoski

Special Analytical Services Department
Technical Division

/evo

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to the public by:

Quinn Smith 4/18/95
Technical Information Officer Date
Oak Ridge K-25 Site

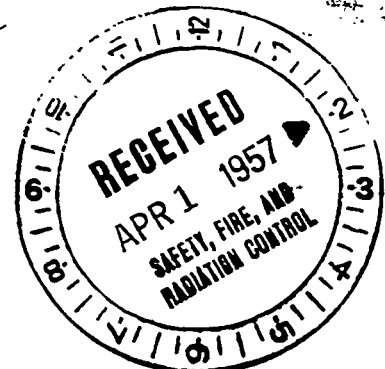


TABLE I
FLUORIDES IN OAK RIDGE GASEOUS DIFFUSION PLANT AREA WATERS

CW-3			CW-4			CW-5		
Poplar Creek at Junction With Clinch River,			Clinch River One Mile Downstream,			Clinch River at K-1513 Pumphouse,		
ppm. F ⁻			ppm. F ⁻			ppm. F ⁻		
Date			Date			Date		
7/27/56	0.1	0.1	11/2/56	0.9	0.7	11/2/56	0.2	
7/31/56	0.2	0.1	11/6/56	0.3	0.3	11/6/56	0.2	
8/3/56	0.2	0.2	11/10/56	0.2	0.9	11/10/56	1.1	
8/7/56	<0.1	0.2	11/13/56	0.3	0.2	11/13/56	0.6	
8/10/56	0.2	0.2	11/16/56	0.2	0.2	11/16/56	0.1	
8/14/56	0.6	0.2	11/20/56	0.4	0.2	11/20/56	0.2	
8/17/56	0.4	0.4	11/23/56	0.1	0.4	11/23/56	0.5	
8/21/56	0.4	0.2	11/27/56	0.3	0.1	11/27/56	2.9	
8/24/56	1.7	0.1	11/30/56	0.5	0.2	11/30/56	0.2	
8/28/56	0.3	0.6	12/4/56	0.2	1.0	12/4/56	0.2	
8/31/56	0.3	0.2	12/7/56	0.2	1.0	12/7/56	0.2	
9/4/56	0.6	1.4	12/11/56	0.2	0.1	12/11/56	0.3	
9/7/56	0.7	0.6	12/14/56	0.5	2.2	12/14/56	0.2	
9/11/56	0.3	0.2	12/18/56	0.7	1.4	12/18/56	0.2	
9/14/56	0.1	0.1	12/21/56	1.3	2.2	12/21/56	0.2	
9/18/56	0.2	0.1	12/25/56	1.8	1.4	12/25/56	0.2	
9/21/56	0.2	0.4	12/28/56	0.3	0.2	12/28/56	0.2	
9/25/56	0.4	0.5	1/1/57	0.3	0.2	1/1/57	0.1	
9/28/56	0.4	0.8	1/4/57	0.2	1.0	1/4/57	1.2	
10/2/56	0.3	0.2	1/8/57	---	---	1/8/57	0.2	
10/5/56	0.5	0.2	1/11/57	---	---	1/11/57	0.2	
10/9/56	0.9	1.9	1/12/57	0.9	0.1	1/12/57	---	
10/12/56	0.3	0.2	1/15/57	0.6	0.1	1/15/57	0.2	
10/16/56	0.3	0.2	1/18/57	0.3	0.4	1/18/57	0.3	
10/19/56	0.7	0.3	1/22/57	0.2	0.2	1/22/57	0.2	
10/23/56	0.5	0.2	1/25/57	0.3	0.2	1/25/57	0.2	
10/30/56	0.5	0.5						
Av.			0.43	0.48	0.32			

51161

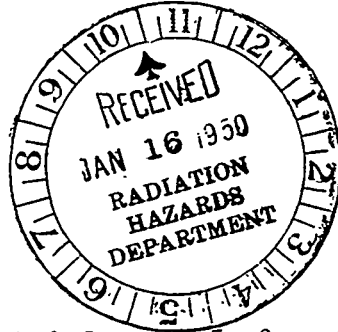
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INTER-COMPANY CORRESPONDENCE

Post Office Box P
OAK RIDGE, TENN.

COMPANY CARBIDE AND CARBON CHEMICALS CORP. LOCATION

TO Dr. H. F. Henry
LOCATION
ATTENTION
COPY TO

DATE January 13, 1950

ANSWERING LETTER DATE

SUBJECT Minimum Flow of Clinch River

A letter dated January 5, from C. E. Center to R. W. Cook, concerning minimum flow of the Clinch River is quoted below. This recommendation obviously is the result of specific studies by X-10 and is consistent with our conclusions concerning the recent experiences of higher than average beta activity in the Clinch River under low flow conditions.

"Reference is made to my letter of August 26, 1949, regarding the minimum flow rate of the Clinch River. Since that time, at a meeting of the Radiation Protection Committee of the United States, Canada and Great Britain, held in Canada on September 26, the Committee recommended permissible limits on certain of the radioactive materials. Also further study has been and is still being made on the most applicable waste disposal system for Oak Ridge National Laboratory under the funds provided in Program "H".

"Until the revised waste disposal system is designed and installed, in order to keep the concentration of radioactive wastes in the Clinch River within the permissible limits recommended at the Chalk River Meeting, it will be necessary to regulate the discharge of such wastes in accord with the flow of the river. With the installation of the waste evaporator, the increase in storage space in the Tank Farm, and the use of White Oak Dam, such regulation is possible except under extraordinary conditions.

"To enable the personnel at the Laboratory to plan the disposal of the radioactive liquid waste, giving consideration to the Clinch River flow rate, it is recommended that TVA make available to the Laboratory a copy of its weekly schedule of release from Norris, or, at least, a statement of the anticipated average flow for the week. With this information, every effort will be made to maintain the average concentration of Clinch River for an extended period of time within the permissible limits. After the modification of our waste disposal system under Program "H", the knowledge of the flow rate will not be as critical as it is at the present time.

"Although the possibility of an ORNL accident in which extraordinary amounts of radioactive materials would be released is remote, the arrangement with TVA should also have provisions wherein large volumes of water could be made available to dilute the activity in Clinch River."

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Date

Technical Information Officer

Oak Ridge K-25 Site

Dr. H. F. Henry
Page Two
January 13, 1950

If we need any information concerning Clinch River flows, particularly as related to X-10 operations, I presume you have and will continue to obtain it from X-10 rather than from any other source. If you have comments in this regard, please discuss them with me.

A. P. Dunlap

A. P. Dunlap
Safety and Inspection Division

APD:mgwk